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LIFE HISTORY AND HABITS OF SOME COMMON PHILIPPINE FLEA BEETLES[1]

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WITH FOUR PLATES

While engaged in field work in plant pest control in the College of Agriculture vegetable gardens in the summer of 1919, the writer had occasion to observe some species of flea beetles which were causing considerable damage to eggplant (*Solanum melongena* L.); roselle, (*Hibiscus sabdariffa* L.); and okra, (*Abelmoschus esculentus* L.). On extending these observations to other parts of the College Campus, and to the vegetable gardens of Manila and Santa Cruz, Laguna, other plants, both cultivated and uncultivated, including ornamentals, were also found to be seriously damaged by the flea beetles.

Adult flea beetles feed on the epidermis of the stem, leaves, buds, and flowers of the host plants, puncturing the leaves and causing them to become yellow and drop, and, consequently, sometimes preventing the plants from bearing fruit. In severe cases the flea beetles bring about almost complete defoliation, so that the plants die for the lack of leaves to manufacture the food necessary for the plant life.

Despite their great importance in the country nothing has been done in the Philippines toward studying the younger stages of these little insects.

Chittenden (1) in *Insects injurious to vegetables* described the flea beetles as follows: "Flea beetles (*Halticini*)[2] constitute a sub-family of the leaf beetles. They are of elongate oval form and similar color, frequently striped like the cucumber beetle, and may be distinguished by their enormously developed hind thighs, which furnish them with powerful leaping ability. The most injurious forms are minute and dark-colored. Their habit of hopping from the plant upon which they are feeding has given them the common name of flea beetles or fleas, some species being known as "potato flea," "cabbage flea," etc., according to the plant infested. Many flea beetles are general feeders, and nearly all are subject to a periodicity, depending on factors with which we are little acquainted, but doubtless in large part traceable to atmospheric conditions, moist weather furnishing the best conditions for the development of the young or larvae, and dry weather being inimical to their increase, this hypothesis being based upon the knowledge that the larvae of many species are subterranean.

"Injury is frequently very severe on young plants and is due in the greatest measure to the ravages of the adult flea beetles which frequently appear in prodigious numbers

[1] Thesis presented for graduation from the College of Agriculture, No. 144; Experiment Station contribution, No. 91.

[2] For the purpose of this paper we are including in our discussion species of Halticinae and Eumolpinae.

in cultivated fields and like a pestilence sweep everything before them, their depredations often necessitating the replanting of entire crops.

"The larvae of most flea beetles develop in weeds, a comparatively small proportion living on cultivated crops. Knowledge of this fact is of value in indicating methods of control."

REVIEW OF IMPORTANT FOREIGN LITERATURE ON ALLIED SPECIES

No local or foreign literature on the biology and habits of Philippine flea beetles is at present available. The larval habits of local species are similar in many respects to those recorded for allied species in other countries. *Psylliodes* spp. studied here, all have boring larvae, and a species of *Psylliodes* is reported from Kiew (2) as boring in rape stems, whereas *P. punctulata* is reported by Quayle (3) as feeding on the roots of garden plants. *Phyllotreta* spp. are recorded as free living larvae almost without exception. (4), (5), (6), (7), (8). *Chaetocnemis* spp. are reported as borers in the larval stage (9), (10). Ramakrishma Ayyar (18) describes the damage by a species of *Longitarsus* whose larvae feed in the berries of *Piper nigrum* in India. Pupation in all species reported takes place in the soil. Authors reporting on various species agree in general as to the type of injury caused by the adult. They are especially harmful to vegetables (11), (12), (4), (13), (10), (8), (14) and to some of the field crops (15), (11), (16). The principal damage occasioned by the adults is the skeletonizing of the leaves. (15), (6), (9). Some records are found of adults injuring the stems of plants (8), an injury which is sometimes severe.

OBJECT OF PRESENT WORK

The object of the present study was to determine the life history and habits of some of the common Philippine flea beetles, with the possibility of finding, in these, hints as to effective methods of preventing their damage. Observations were made on several species, but since the writer has had to limit his work, only three species, *Psylliodes balyi* Jac., *Psylliodes splendida* Har., and *Nisotra gemella* Er. were studied in detail, the rest being only observed in the field for their occurrence, abundance, and habits.

TIME AND PLACE OF PRESENT WORK

This work was begun in 1919, and has been carried on from that time until the present writing, February 1922, at the College of Agriculture, Los Baños. During this time observations on occurrence, abundance, and habits were noted. Some of these observations were also made at the Manila gardens, Santa Cruz, Laguna, and the Lamao Experiment Station, Bataan, in 1920. The studies on the life histories of these beetles were made from June to December, 1921, in the Insectary of the Department of Entomology at the College of Agriculture.

DESCRIPTION OF METHODS AND EQUIPMENT

Several breeding methods were tried during the course of these experiments with varying degrees of success. For the purpose of aiding future investigators, the following methods which the writer has found successful are described.

For flea beetles with boring larvae, such as *Psylliodes balyi* Jac. and *Psylliodes splendida* Har., glass tubes of 1.5 millimeters diameter cut into lengths of from 15 to 20 millimeters were used. The ends were covered with cheese cloth of mesh fine enough to confine the larvae. Couples found in copula were placed in the tubes and supplied with fresh leaves each day. Before removal the leaves

were carefully examined for eggs. When eggs were found, they were transferred to individual petri dishes for further observation. The newly hatched larvae were transferred to individual growing plants which were enclosed with cheese cloth. Observations were made at various times each day.

For the flea beetles with free living larvae, such as *Nisotra gemella* Erichs., small tumblers were used half filled with moist friable earth. Copulating couples were confined by means of a cheese cloth top and fresh leaves were supplied each day. Examination was made daily for eggs, and when these were found, they were transferred to separate petri dishes. For life history studies, these petri dishes were half filled with moist soil and supplied with fresh food each day.

BIOLOGICAL STUDY OF *PSYLLIODES BALYI* (?) Jacoby[3]

1884—Jacoby, (17) Notes Leyd. Mus. VI. 30 (Sumatra).

1887—Jacoby, (18) Veth. Midden-Sumatra. Nat. Hist. I. 158. (Sumatra).

1916—Schultze, (19) Cat. Col. Phil. Is., Phil. Jour. Sci. XI D. p. 93 (Luzon, Manila).

LIFE HISTORY

Couples of *Psylliodes balyi* Jac. were confined in separate cages, fed with fresh leaves each day, and kept under close observation in order that notes could be taken on the life history period. As soon as eggs were laid, they were transferred to individual cages and numbered. Considerable difficulty was encountered in obtaining complete life histories due to a high percentage of death in larval stage. The records obtained from these studies are tabulated in Table I.

Table I.—*Showing the incubation period for eggs of Psylliodes balyi* Jac.

Cage number.	Date of confinement.	Date laid.	Number laid.	Date of hatching.	Number hatched.	Per cent hatched.	Lengh of incubation period.
							days
1	8/26/21	9/ 2/21	16	9/ 8/21	10	62.5	6
1	8/26/21	9/ 7/21	3	9/11/21	3	100	4
2	8/26/21	8/28/21	10	9/ 2/21	7	70	5
2	8/26/21	8/30/21	2	9/ 6/21	2	100	6
2	8/26/21	8/31/21	8	9/ 5/21 9/ 6/21	3 5	37.5	5
3	8/26/21	8/30/21	16	9/ 7/21	3	50	7.5
3	8/26/21	8/30/21	4	9/ 4/21 9/ 5/21	1 1	25	5 8
4	8/27/21	8/28/21	15	9/ 8/21	11	80	6
4	8/27/21	8/30/21	7	8/ 4/21 9/ 6/21	3 9	43.8	5 6
5	8/27/21	8/31/21	19	9/ 7/21 9/ 8/21	2 4	78.9	7 8

[3] Charles Fuller Baker, Dean of the College of Agriculture, to whom the author is indebted for this determination, states that the determination of this insect is questionable.

TABLE II.—*Showing the life history of Psylliodes balyi Jac. under laboratory conditions.*

Egg Number.	Date laid.	Date hatched.	Date in ground.	Date pupated.	Date emerged.	Length of egg stage.	Length of larval stage.	Length of pupal stage.	Total.
						days.	*days.*	*days.*	*days.*
A_1.....	8/10/21	8/15/12	8/31/21	9/ 4/21	9/12/21	5	20	8	33
A_2.....	8/10/21	8/15/21	8/29/21	9/ 5/21	9/11/21	5	21*a*	6	32
A_3.....	8/10/21	8/15/21	8/31/21	9/10/21	9/15/21	5	26	5	36
A_4.....	8/10/21	8/17/21	9/ 3/21	9/11/21	9/17/21	7	25	6	38
A_5.....	8/13/21	8/19/21	Died	*a*	*a*	6	*a*	*a*	*a*
A_6.....	8/15/21	8/21/21	9/ 7/21	9/14/21	9/18/21	6	24	4	34
Average.						5+	23+	5+	35

a In several cases the exact date was not definitely known owing to the change having taken place at night.

Egg.—The egg is pale yellow in color, spindle-shaped, broadest in the middle and tapering slightly and equally toward each end. The surface is roughened and marked with hexagonal reticulations. The average size from a series of measurements was 0.417 x 0.120 millimeter. When first laid the egg is shiny but just before hatching it becomes dull. The chorion is white.

In the cages, females laid their eggs on both faces of the leaves, principally along the midrib, although a few were deposited indiscriminately on the leaf surfaces.

Larva.—When newly hatched, the larva is a small legless grub, sparsely hairy, approximately 0.4 millimeter in length and 0.1 millimeter in width, shiny white and with a small light brown head about one half the width of the body. As it grows older it becomes pale yellow and finally light brown. Upon hatching the larva begins to feed immediately. The larvae which hatch from eggs laid on the midrib bore into it and down into the petiole and live on tissue of the stem. Those which hatch from eggs laid in cracks on the stem bore directly into the stem and feed there. Larvae were found feeding upon the stems, midribs, and petioles. Observations on the rate of feeding of the newly hatched larvae showed that these minute little animals can travel 5 centimeters in 5 minutes down the midrib of a leaf, making their tunnel as they feed.

Pupa.—The pupa resembles the adult both in size and general form. It is soft and white and finely pubescent. When the larvae are ready to pupate, they crawl out of the stem and fall to the ground. Pupation takes place in the soil. The writer has never found pupae within the plants but has had no difficulty in finding them in the soil around the plants in the laboratory.

Adult.—When the adult emerges, it hides in the soil for from one day to two days. At first it is white in color, changing later to brown and then to shiny black. Feeding commences when it becomes brown. Although the size varies in individuals, the males average considerably smaller than the females, sometimes only one half as large. Copulation takes place in from 7 to 10 days after emergence.

TABLE III.—*Showing the relative infestation of main stems, branches, and midribs or petioles.*

Plants of *Solanum melongena* Linn. examined for flea beetle attack, showing extent and location of attack.*a*

No.	Larvae found in main stem.	Larvae found in branches.	Larvae found in midrib and petioles.
1.	1	4	0
2.	3	2	2
3.	0	2 larvae 10 fresh eggs 2 chorions	0
4.	3	5	0 2 eggs
5.	0	7 2 eggs	1 egg
6.	0	6 3 eggs	0
7.	1	4	1 larva found in the petiole of the fruit.
8.	2	3	0
Total	10	50	6

a No attempt was made in this examination to distinguish between the larvae of *P. balyi* Jac. and *P. splendida* Har.

In the laboratory breeding cages, the adults were found to like only very fresh leaves; when the leaves became five or six hours old they no longer fed upon them. The most satisfactory food for laboratory purposes was found to be the new leaves of the seedling eggplant.

During the experiment several beetles were inadvertently overlooked and received no food for from 3 to 5 days. These beetles lived and seemed to show no ill effects from their enforced starvation. Large collections of adults from the fields, confined without food in jars, died after one day, none living beyond three days.

HOST PLANTS

Wild plants.—No wild hosts of this beetle were observed but the writer suspects that it may feed upon Tarambulo (*Solanum cumingii* Dunal.), a rather common wild species of *Solanum* in the Philippines. This supposition is based on the fact that a spineless variety of *S. cumingii* which is cultivated on the College of Agriculture Campus, is a favored host plant of this pest.

Cultivated.—Both larvae and adults were found abundantly on *Solanum melongena* L., the former in midribs, petioles, and stems, the latter on the leaves and green tissue, or epidermis of the stems. Adults were also observed feeding on the leaves of an ornamental, *Solanum grandiflorum* P. and R., in September, 1919, when there were no eggplants growing in the fields of the College of Agriculture.

OCCURRENCE AND ABUNDANCE

Although this beetle breeds throughout the year it appears most abundantly from the latter part of December until July. During August and September the beetles are less numerous, but many couples in copula were observed in those months. In October and November they were quite scarce.

Observations made in December and January 1921 and 1922 on 100 eggplants at the College of Agriculture, showed an infestation of from 3 to 65 beetles per plant. These observations were made during bright sunshiny days. Notes on a garden of eggplants in the Barrio of Bayog, Los Baños, on December 30, 1921, show that *Psylliodes balyi* Jac. and *P. splendida* Har. were extremely abundant, feeding upon both surfaces of the leaves but seeming to prefer the upper. This garden was seriously damaged; most of the plants were defoliated and eight had succumbed to the attack of the beetles.

HABITS

The beetles are most active between the hours of 8 and 10 in the morning. At this time they feed upon the upper surface of the leaves and do most of their damage. During the hot part of the day many of them hide under the leaves and, although they feed then, they are much less active and the amount consumed is considerably less. Late in the afternoon they again become active. In the very early morning, when the leaves are covered with dew many of them may be found hiding on the lower surface of the leaves; they do not feed at this time.

Copulation has been observed principally in the morning and evening; sometimes at night. The process does not interfere with the feeding of the female, who continues as though the male was not there. Often as long as one hour is occupied in this process. It often happens that the female objects to the advances of the male, at which times she shoves him away with her hind legs.

The female, as a rule, lays her eggs in rows along the midribs of the upper surface of the leaves, sticking them flat on the leaf or in cracks in the stems and branches. Quite often they are found on the scars left by fallen leaves. Occasionally eggs may be found in masses or singly on almost any part of the plant.

The larvae live in the tissue of the stems, midribs, and petioles of both leaves and fruit. Their work seriously injures the plant, for most of the branches attacked die. An attacked plant can be recognized by the defoliation and dead tips of the branches. Those individuals which tunnel just under the bark of the stem produce characteristic black corrugations. In most cases, however, the larvae live and feed in the pith of the stem.

The adults attack all but the very thin young leaves, eating small irregular holes in the epidermis. Later, these holes dry up and the lower portion falls out leaving the leaf with a characteristic perforated appearance. These holes are the size of an adult beetle or slightly larger. Heavy infestations soon result in defoliation. When there are no leaves left on the plant, the adults eat the epidermis of the stem. In fields around the College of Agriculture the beetles are found on practically 100 per cent of the eggplants. Near the old boiler of the College is an eggplant plantation of some two years standing. The first year this plantation produced a good harvest, but in 1921 very little fruit was produced and many plants had no fruit at all. This was due principally to the attacks of *Psylliodes balyi* Jac. and *P. splendida* Har. which had killed the main stems of most of the plants. In some cases the plants themselves have been killed.

BREEDING PLACES

The principal breeding place is the eggplant (*Solanum melongena* Linn.). In the absence of this plant the beetle probably breeds on *Solanum cumingii* Dunal. or *S. grandiflorum* P. and R. although larvae have not been observed on the latter.

METHODS OF DISTRIBUTION

While this beetle can fly, it more often travels from plant to plant by walking or jumping. Normally it walks from leaf to leaf and plant to plant, but if disturbed it will jump. Seedlings in boxes or beds are favorite feeding places of this insect and are often quite seriously damaged. The adults are not easily disturbed from the seedlings and even the handling during transporting or transplanting does not free the plants from them. Undoubtedly this is an important factor in the distribution of these pests.

BIOLOGICAL STUDY OF *PSYLLIODES SPLENDIDA* (?) harold[4]

1877—Harold, (20) Deutsche Ent. Zeits. p. 364.
1916—Schultze, (19) Cat. Col. Phil. Is., Phil. Jour. Sci. XI D, p. 93.
(Luzon, Manila: Cebu, Toledo.)

LIFE HISTORY

In general, the life history and habits quite closely follow those of *P. balyi* Jac. In fact, during field observations, especially on the larvae, distinction between the habits of the two species was impossible. Table IV shows a series of breeding, indicating the average length of the various stages under laboratory conditions.

Table IV.—*Showing the life history of Psylliodes splendida Har. under laboratory condition.*

Egg number.	Date laid.	Date hatched.	Date puputed.	Date emerged.	Length of egg stage.	Length of larval stage.	Length of pupal stage.	Total.
					days.	*days.*	*days.*	*days.*
B_1.....	8/12/21			9/13/21				32
B_2.....	8/14/21	8/21/21	9/ 6/21	9/10/21	7	16	4	27
B_3.....	8/14/21	8/19/21	9/ 5/21	9/11/21	5	17	6	28
B_4.....	8/14/21	8/19/21	9/ 7/21	9/14/21	5	19	7	31
B_5.....	8/14/21	8/20/21	9/ 7/21	9/12/21	6	18	5	29
B_6.....	8/14/21	8/21/21	9/ 4/21	9/ 9/21	7	14	5	26
Average..					6	17	5	28

Egg.—The eggs of *P. splendida* Har. are shiny pale yellowish in color, and oval in shape, sometimes slightly tapering toward one end, The surface is roughened and with hexagonal reticulations as in *P. balyi* Jac. Just before hatching

[4] Charles Fuller Baker to whom the author is indebted for this determination states that the determination of this insect is questionable.

the surface becomes dull. The chorion is white. The average size, from a series of measurements, is 0.472 millimeter x 0.239 millimeter. Couples were confined to determine the length of the egg stage. Table V shows the incubation period for 4 hatches of eggs.

TABLE V.—*Showing the incubation period of eggs of Psylliodes splendida Har.*

Cage number.	Date of confinement.	Date laid.	Number laid.	Date of hatching.	Number hatched.	Per cent hatched.	Length of incubation period.
							days.
1	8/29/21	9/ 4/21	20	9/11/21	7	75	7
				9/12/21	8		8
2	8/29/21	9/ 1/21	3	9/ 8/21	3	60	7
		9/ 3/21	9	9/ 9/21	5		6
		9/ 4/21	8	9/10/21	4		6
3	8/29/21	9/ 4/21	10	9/11/21	3	40.9	7
		9/ 7/21	12	9/14/21	6		7
4	8/29/21	9/ 2/21	11	9/10/21	7	72.7	8
				9/12/21	1		10
Average incubation period							8+

Larva.—Except for size there is little difference between the larvae of *P. splendida* Har. and *P. balyi* Jac. The average size of the full grown larva of *P. splendida* Har. is 6.7 millimeters x 1.3 millimeters. Both species live in the tissue of the midribs, petioles, and stems.

Pupa.—As is the case with *P. balyi* Jac. the full grown larvae of *P. splendida* Har. leave their tunnels and drop to the ground to pupate. The pupae are white and resemble the adult in size and form.

Adult.—The imago remains in the ground for a day after emerging, hiding under particles of soil. Upon emergence it is white and soft but soon becomes darker, finally becoming metallic blue. Feeding starts soon after leaving the soil.

HOST PLANTS

Larvae and adults have the same host plants as *P. balyi* Jac.

OCCURRENCE AND ABUNDANCE

These insects appear at the same time and in company with *P. balyi* Jac., the latter, however, is far more abundant. Due to its slightly larger size, *P. splendida* Har. may do more damage individually, but *P. balyi* Jac. is decidedly the more numerous and therefore the more harmful species. In types of damage, methods of distribution, and breeding places, it closely resembles *P. balyi* Jac. Their relative abundance is shown in Table VI, from figures obtained by rearing the larvae found in eggplants in the field.

TABLE VI.—*Psylliodes balyi Jac. and Psylliodes splendida Har.*

No. of plants.	Date confined.	Date of emergence of adults from soil.	No. of adults of *Psylliodes balyi* Jac.	No. of adults of *Psylliodes splendida* Har.
1	7/15/21	8/13/21	2	0
		8/17/21	4	1
2	7/15/21	8/11/21	3	1
		8/15/21 (?)	2	2
		8/20/21	1	0
3	7/15/21	8/10/21	3	0
		8/16/21	1	3
		8/17/21	0	1
4	7/20/21	8/12/21	2	2
		8/16/21	3	1
5	7/20/21	8/20/21 (?)	4	2
		8/24/21	0	5
6	7/20/21	8/10/21	1	2
		8/12/21	2	0
		8/19/21	2	2
7	8/16/21	9/11/21	1	0
		9/12/21	2	2
8	8/16/21	9/11/21	2	0
9	8/21/21	9/13/21	1	0
		9/19/21	1	0
10	8/21/21	9/13/21	4*a*	0
		9/15/21	3*a* 1	1
Total....			45	26

a Dead.

BIOLOGICAL STUDY OF *NISOTRA GEMELLA* erichs.[5]

1834—ERICHS., (21) Nov. Act. Leop. Car., 16, Suppl. 1. p. 275. (Manila).
1887—JACOBY, (22) Veth. Midden Sumatra Nat. Hist., 1. p. 153 (Sumatra).
1913—WEISE, (24) Phil. Jour. Sci. 8 D. p. 233—(Luzon).
1916—SCHULTZE, (23) Phil. Jour. Sci., XI D. p. 92 (Luzon, Benguet, Baguio; Isabela, Panauan; Cagayan, San Luis; Rizal, Montalban Gorge; Palawan, Bacuit).

LIFE HISTORY

Egg.—The eggs are ovoid, the surface appearing smooth under the microscope, with fine white dotting. When first laid they are yellow in color, turning grayish before hatching. The average size from a series of measurements was 0.527 x 0.197 millimeter. After hatching, the chorion is white. The eggs are deposited in groups of from 5 to 11 around the base of a plant. The majority are deposited from 2 to 3 millimeters under the soil, although some are laid on or

[5] Determined by Charles Fuller Baker.

under the dead and decaying leaves below the plant. Sometimes these groups are laid in compact masses, other times are rather scattered. Table VII shows the average incubation period under laboratory conditions.

TABLE VII.—*Showing the incubation period for eggs of Nisotra gemella* Er.

Cage number.	Date of confinement.	Date laid.	Number laid.	Date of hatching.	Number hatched.	Per cent hatched.	Length of incubation period.
							days.
1	7/25/21	7/29/21	34	8/ 3/21	24	70	5
2	7/25/21	8/ 2/21	21	8/ 8/21	15	71	6
3	9/25/21	8/15/21	40	8/21/21	25	62	6
4	7/25/21	8/20/21	30	8/25/21	19	60	5
5	8/21/21	9/13/21	13	9/20/21	6	47	7
		9/17/21	10	9/23/21	4		6
6	8/21/21	9/13/21	11	9/20/21	3	85	7
		9/18/21	17	9/23/21	11		5
7	8/21/21	9/13/21	2	?	(?)		
		9/14/21	7	9/22/21	14	48	8
		9/17/21	28	9/23/21	3		6
8	8/21/21	9/13/21	1	9/22/21	1		9
		9/14/21	9	9/23/21	8	54	9
		9/19/21	12	9/25/21	3		6
9	8/30/21	9/ 9/21	53	9/10/21	13	71	1 (?)
				9/12/21	6		3
				9/13/21	12		4
				9/14/21	3		5
				9/15/21	2		6
				9/18/21	2		9
10	8/30/21	9/21/21	12	(?)*a*	7	57	
		9/25/21	47	(?)	33		
11	8/30/21	9/19/21	13	(?)	8	63	
		9/20/21	45	(?)	29		
12	9/10/21	9/10/21	6 p.m. 27	9/15/21	23		5
		9/12/21	31	9/16/21	7		4
Average.			40.16		11.74	61.5	5.8

Larva.—The young larva is light brown in color, head the same color as the body. The last visible posterior segment is black. The body is covered with short fine hairs. As the larva grows older it becomes grayish in color. The full grown larva measures from 8 to 9 millimeters in length and 1 to 1.5 millimeters in width. The young larvae are very active, moving from place to place around the base of the plant on the surface of the soil, and hiding under the particles of soil or playing dead when disturbed. They do not commence feeding for from one to

one and a half hours after hatching, spending the time moving about on the surface of the soil, finally finding the stem of the plant and working their way down to the roots. A few do not go to the roots, but feed around the base of the plant, especially if the plant is young and tender. Larvae are often found clinging to the under surface of fallen green leaves. The usual food seems to be the small tender roots, although in the laboratory they would eat and do well on the green stem or fresh fruit of okra. When from 5 to 8 days old, the larvae feed throughout the day without stopping, later on they feed only occasionally, resting between meals. When almost mature the feeding seems to be confined to the early morning and late afternoon. Before pupating, the larvae form rounded or oval shaped cells in the soil, 1 to 1.5 millimeters below the surface. Larvae which have had an abundance of food and have moist soil to pupate in remain inactive in the pupal cell some time before pupating. On the other hand, larvae which have not had sufficient food and have dry soil in which to make the cell, pupate almost immediately.

Pupa.—The pupa resembles the adult insect in general form. The color is white, with black eyes. The body is covered with fine white hair, principally on the ventral surface. From 5 to 9 days are spent in this stage. (See Table VIII.)

TABLE VIII.—*Showing the life history of Nisotra gemella Er. under laboratory conditions.*

Egg number.	Date laid.	Date hatched.	Date of beginning of pupation.	Date pupated.	Date emerged.	Length of egg stage.	Length of larval stage.	Length of pupal stage.	Total.
						days.	*days.*	*days.*	*days.*
C_1	10/10/21	10/15/21	10/28/21	10/31/21	11/ 6/21	5	16	6	27
C_2	10/10/21	10/17/21	(?)	11/ 6/21	11/14/21	7	20	8	36
C_3	10/10/21	10/18/21	(?)	(?)	(?)	8	(?)	(?)	(?)
C_4	10/10/21	10/16/21	10/29/21	11/ 2/21	11/10/21	6	17	8	31
C_5	10/13/21	10/18/21	10/30/21	11/ 5/21	11/14/21	5	18	9	32
C_6	10/15/21	10/21/21	10/28/21	11/ 5/21	11/14/21	6	15	9	30
C_7	10/21/21	10/26/21	11/ 5/21	11/13/21	11/20/21	5	18	7	30
C_8	10/30/21	11/ 5/21	11/18/21	11/24/21	11/30/21	6	30	6	32
C_9	10/31/21	11/ 5/21	11/17/21	11/24/21	11/29/21	5	19	5	29
C_{10}	11/ 5/21	11/11/21	11/23/21	11/29/21	12/ 4/21	6	18	6	30
C_{11}	11/14/21	11/19/21	12/ 2/21	12/ 7/21	12/13/21	5	19	6	30
Average						5.8	18	7.3	30.6

Adult.—The young adult remains in the pupal chamber for 2 or 3 days after emerging. At first it is white. It hides among the soil particles for a day or so without feeding, the elytra becoming light brown on the second day, later blue-black.

Egg laying.—The female starts laying eggs from 18 to 20 days after emergence. The average number of eggs from 12 females was found to be 40+(See Table VII).

Longevity.—Adults kept in a container without food died in from 7 to 10 days.

Food.—In the laboratory the adults did equally well on the young leaves of Calot-calotan (*Triumfetta bartramia* L. and *T. semitriloba* Jacq.) Calot-calotan (*Urena lobata* L.), Okra and Roselle.

Habits.—When the adults are disturbed, they stop feeding and remain motionless. If greatly disturbed they either fall to the ground or hop to another leaf. The adults feed in the early morning and late afternoon. Copulation takes place either day or night. If the couple are in copula during the feeding hours the female proceeds with her feeding apparently undisturbed.

HOST PLANTS

Wild plants.—

1. *Abelmoschus moschatus* Medik. (Castuli, Capuli).
2. *Triumfetta bartramia* L. (Calot-calotan).
3. *Triumfetta semitriloba* Jacq. (Calot-calotan).
4. *Urena lobata* L. (Calot-calotan).

Cultivated plants.—

1. *Abelmoschus esculentus* (L.) Moench. (Okra, Gumbo).
2. *Hibiscus sabdariffa* L. (Roselle).
3. *Hibiscus rosa-sinensis* L. (Gomamela).
4. *Malvaviscus* sp. (C. of A. 1152).

OCCURRENCE AND ABUNDANCE

From June to September, 1921, there was no okra nor roselle growing on the College Campus. During that time material for study was easily obtained from calot-calotan. This plant is very abundant in the waste places around the Campus. In a field in Coconut Grove near the entrance to College Campus practically every plant was attacked, the beetles being most numerous on the younger plants. When okra and roselle were planted in the latter part of September, 1921, the adults were observed feeding on both, but seeming to prefer the latter. They were found in abundance on castuli throughout the year. While specimens may be found with ease at any season, they are particularly abundant during December and January.

NATURE AND EXTENT OF DAMAGE

The adults feed almost exclusively on the under surface of the leaves, eating small holes entirely through the leaf. When numerous on a leaf these holes may practically skeletonize it. Some preference is shown for the newer and younger leaves. Although the extent of damage would appear serious, especially on roselle, the growth in height is not retarded. The body of the attacked plant, however, is weak. Unless practically skeletonized, the leaves turn yellow after several days and when the plants are mature, the older, perforated leaves fall. At this time the beetles leave the leaves and start feeding on the epidermis of the stem.

Most damage is done to roselle, the introduced Hawaiian varieties of *Hibiscus rosa-sinensis* L., and the wild host plants. Okra is only slightly attacked, and the writer has never observed them on the native gomamela.

BREEDING PLACES

In the absence of its cultivated hosts this beetle can and does exist on its abundant wild hosts. In fact, excepting roselle, the wild hosts seem to be preferred.

METHODS OF DISTRIBUTION

Nisotra gemella Er. is widely distributed throughout the archipelago. Aside from its own ability to fly and hop, man is probably responsible for transporting the pest on parts of the wild or cultivated fiber plants which are its hosts. The larvae are carried on the earth around the roots of its host plants when entire plants are shipped.

MISCELLANEOUS NOTES ON OTHER SPECIES OF FLEA BEETLES

LUPEROMORPHA PROLIXA gr.[6]

This beetle was observed feeding upon the flowers, particularly the petals, of nearly all the flowering plants of the College Campus. On the gomamela and alfalfa flowers the irregular holes perforate the petals but on rosal only the epidermis is eaten. This beetle is found throughout the year, more abundant, perhaps, in the months of August, September, and October. In going from place to place it uses its wings more often than the species previously discussed, some of the flights measuring in direct distances about 25 meters. The eggs of this species are laid in the soil.

LONGITARSUS MANILENSIS weise[7]

The wild host plant of this insect around the campus of the College of Agriculture is *Crotalaria*. This plant is also cultivated here as a cover crop. In July, 1921, the beetle was found occasionally, perforating the leaves of sitao (*Vigna sesquipedalis* L.) in the trial beds of the College. It is an abundant species throughout the year and does considerable damage to *Crotalaria*, feeding on the lower surface of the leaves. A light touch does not disturb it, but, if repeatedly interfered with, it jumps. The writer has never observed this species flying. In the hot part of the day and especially when the wind is blowing, the beetles are very restless moving from place to place, but not feeding. In the rain they hide beneath the leaves. The feeding hours are from 8 until 10 in the morning and from about 2:30 to 6 in the afternoon.

The eggs greatly resemble those of *Psylliodes balyi* Jac. The average size is 0.367 millimeter x 0.243 millimeter. They are laid in the soil. The larvae feed upon the roots of *Crotalaria*.

NISOTRA sp.[8]

A common flea beetle on gomamela and *Malvaviscus* sp., the adults feeding upon the buds, leaves and flowers. It is usually found on the lower surface of the leaves although occasionally it may be found on both surfaces. The damage is from the perforation of the leaves.

PAGRIA GRAPHICA weise.[9]

These beetles are abundant at the College in the months of July and August. Some may be seen almost any time of year but during January and February

[6] Determined by Charles Fuller Baker.

[7] Determined by Charles Fuller Baker.

[8] Specimens are in the collection of the Department of Entomology, College of Agriculture, Los Baños, No. 00119 F. Determined by Charles Fuller Baker.

[9] Determined by Charles Fuller Baker.

they become rather scarce. They are very destructive to sitao (*Vigna sesquipedalis* L.); Pa-ayap (*Vigna sinensis* L.); Patani (*Phaseolus lunatus* L) and batao (*Dolichos lablab* L.). They may also be found on wild beans and abundant on *Desmodium tortuosum* D. C.[10], a plant used for a cover in the Southern United States and evidently an escape here, according to Dr. Merrill. These beetles make small holes in the epidermis of the lower surface of the leaves. The damage, however, is sometimes severe.

LONGITARSUS sp.[11]

This tiny yellow beetle is plentiful during the months of July and August on *Bridelia stipularis* (Linn.) Blume,[12] but has not been observed during the rest of the year. It makes small holes in the leaves and sometimes completely skeletonizes them. The oval white eggs are deposited in the soil.

PSYLLIODES sp.[13]

During the months of July, August, September and October this beetle is abundant on *Amaranthus*. The adult feeds upon the leaves.

HESPERIA sp.[14]

Specimens of this beetle were found flying, and also on the flowers of gomamela on Faculty Hill above the College. Small irregular holes are made in the petals. It was very plentiful in September, October, and November, 1921. The small elongate white eggs are laid in the soil. The average size is 0.315 millimeter x 0.190 millimeter. Slight damage is occasioned by this species.

PHYLLOTRETA sp.[15]

Considerable injury from this species was observed in gardens in Santa Cruz and Los Baños, Laguna, and in the Manila garden near Paco Station, on mustard, pechay and radish. On radish, however, the damage was less than on the other two. The damage consisted in numerous small perforations of the leaves. They were most abundant during October and November in 1920 and January and February 1921. At times the damage from this beetle is most serious.

CHAETOCNEMA sp.[16]

In September, 1921, this species was found in large numbers on young upland rice, leaving the rice when the grain became mature. The upper surface of the leaf was eaten, parallel to the veins, the leaf later turning yellow and drying up. Often the adult encloses itself in the newly unfurled leaves. It has also been observed on lemon grass (*Andropogon citratus D.C.*). Guinea grass (*Panicum maximum* Jac.) and corn (*Zea mays* L.)

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[10] Determined by E. D. Merrill, Director, Bureau of Science, Manila.

[11] Specimens are in the collection of the Department of Entomology, College of Agriculture, Los Baños, No. 00119 H. Determined by Charles Fuller Baker.

[12] Determined by E. D. Merrill, Director, Bureau of Science, Manila.

[13] Specimens are in the collection of the Department of Entomology, College of Agriculture, Los Baños, No. 00119 I. Determined by Charles Fuller Baker.

[14] Specimens are in the collection of the Department of Entomology, College of Agriculture, Los Baños, No. 00119 J. Determined by Charles Fuller Baker.

[15] Specimens are in the collection of the Department of Entomology, College of Agriculture, Los Baños, No. 00119 K. Determined by Charles Fuller Baker.

[16] Specimens are in the collection of the Department of Entomology. College of Agriculture, Los Baños, No. 00119 L. Determined by Charles Fuller Baker.

PHYLLOTRETA sp.[17]

The writer has observed this beetle in considerable numbers during January, February, and March, in the Manila gardens near Paco Station. During the rainy season it becomes quite scarce. It attacks mustard seriously and pechay slightly, skeletonizing the leaves, often killing mustard plants.

HOST PLANTS OF FLEA BEETLES

PSYLLIODES BALYI Jac. (Halticinae.)

CROP PLANTS

Solanum melongena Linn. (Eggplant)
Solanum cumingii Dunal (Tarambulo)

ORNAMENTAL PLANTS

Solanum grandiflorum P. & R.

PSYLLIODES SPLENDIDA Har. (Halticinae.)

CROP PLANTS

Solanum melongena Linn.(Eggplant)
Solanum cumingii Dunal (Tarambulo)

ORNAMENTAL PLANTS

Solanum grandiflorum P. & R.

NISOTRA GEMELLA Er. (Halticinae.)

CROP PLANTS

Hibiscus sabdariffa L. (Roselle)
Abelomoschus esculentus (L) Moench, (Okra, Gumbo)

ORNAMENTAL PLANTS

Hibiscus rosa-sinensis L. (Gomamela)
Malvaviscus sp.

WILD PLANTS

Abelmoschus moschatus Medik (Castuli, Calupi)
Urena lobata L. (Calot-calotan)
Triumfetta semitriloba Jacq. (Calot-calotan)
Triumfetta bartramia L. (Calot-calotan)

LUPEROMORPHA PROLIXA Er. (Halticinae.)

CROP PLANTS

Medicago sativa L. (Alfalfa)
Arachis hypogaea L. (Peanut)
Zea mays L. (Corn, Maize).

ORNAMENTAL PLANTS

Gardenia florida L. (Rosal)
Hibiscus rosa-sinensis L. (Gomamela)

LONGITARSUS MANILENSIS Weise. (Halticinae.)

CROP PLANTS

Vigna sinensis L. (Pa-ayap)
Crotalaria incana L[18] (Latuc-latucan, Patoc-patocan)

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[17] Specimens are in the collection of the Department of Entomology, College of Agriculture, Los Baños, No. 00119 O. Determined by Charles Fuller Baker.

[18] Sometimes used as cover crop at the College of Agriculture

NISOTRA sp. (Halticinae)

ORNAMENTAL PLANTS
Hibiscus rosa-sinensis L.
Malvaviscus sp.

PAGRIA GRAPHICA Ws. (Eumolpinae.)

CROP PLANTS
Phaseolus lunatus L. (Patani)
Dolichos lablab L. (Batao)
Vigna sesquipedalis L. (Sitao)
Vigna sinensis L. (Pa-ayap)
WILD PLANTS
Desmodium tortuosum D. C.

LONGITARSUS ? sp. (Halticinae)

WILD PLANTS
Bridelia stipularis (Linn) Blume.

PSYLLIODES sp. (Halticinae)

WILD PLANTS
Amaranthus sp.

HESPERA sp.

CROP PLANTS
Zea mays L. (Corn)

ORNAMENTAL PLANTS
Hibiscus rosa-sinensis L. (Gomamela)

PHYLLOTRETA sp. (Halticinae)

CROP PLANTS
Brassica sp. (Pechay, mustard)
Raphanus sativus L. (Radish)

CHAETOCNEMA sp. (Halticinae)

CROP PLANTS
Oryza sativa L. (Rice)
Zea mays L. (Corn)
Hibiscus sabdariffa L. (Roselle)
ORNAMENTAL PLANTS
Andropogon citratus D. C. (Tanglad, lemon grass)

PHYLLOTRETA sp. (Halticinae).

CROP PLANTS
Brassica spp. (Mustard, pechay)

SPRAY EXPERIMENTS FOR THE CONTROL OF FLEA BEETLES

Spray experiments were first undertaken in April, 1919, on the small eggplant plots of the College of Agriculture vegetable garden. The plants were sprayed with a solution of paris green (formula No. 1) each week for a month. Observations on its effects were carefully noted every day. Fairly good results were obtained but not sufficient to recommend the spray for that purpose.

In July, a mixture of paris green and Bordeaux(formula No. 2) was tried. The spraying was done as before. Daily observations showed a gradual decrease in the numbers until the plants were practically free of the pests. The same formula was then used by an agronomy class on plots of roselle, in a planting of 16 plots. As a result of the spraying, these treated plants developed normally and were almost entirely free from flea beetle infestation. The unsprayed plots showed various degrees of infestation and damage from medium to very severe. The difference was very striking. No burning was observed.

The spray solutions were made from the Standard Formulae of the Department of Entomology.

Formula 1.——

Paris green	120 grams
Air slaked lime	600 grams
Water	200 liters.

Make a paste with the paris green, add the lime, then strain through a sieve into a tank containing the requisite amount of water. Keep well agitated while spraying.

Formula 2.——

Copper sulfate	1.8 kilograms
Stone lime	1.8 kilograms
Water	190 liters

Dissolve the copper sulfate in hot water. Add sufficient water to make 95 liters. Slake the lime and add sufficient water to make 95 liters. Pour both solutions into a third container at the same time. Agitate vigorously and strain.

To each 200 liters of Bordeaux solution add 120 grams of paris green. Keep well agitated while spraying.

SUMMARY AND CONCLUSIONS

Thirteen species of flea beetles were encountered during the course of this work, which are included under six different genera. The habits of three of these, *Psylliodes balyi* Jacq. *Psylliodes splendida* Har. and *Nisotra gemella* Er., which are rather common on the College Farm, were studied in detail. The rest, which are more or less numerous depending on the locality and season of the year, were studied in the field.

Two species studied were observed to lay their eggs in the cracks of the stems and branches, the other species usually laid their eggs in the ground or under dead leaves. On the whole the period of egg incubation lasted from 5-10 days depending on the species. Good percentages of hatch were obtained in the laboratory.

The larvae of the different species were observed to fall under two classes as regards their habits. One class, represented by *Psylliodes* spp., bores into the stem, often-times going into the pith and spending the entire larval stage inside

the stem. The other class, represented by *Nisotra gemella* Er., digs into the ground and feeds on the tissues of the root. The larval stage is very destructive with most of the species. The larval stage lasts from 16 to 27 days, although in the case of *Nisotra* it is generally shorter.

Pupation of all the different species takes place in the soil. It lasts from 4 to 8 days depending on the species.

The adult stage is the most destructive stage with some species. The life cycle is completed in from 26 to 45 days. Some species have very short life cycles while other have long ones, lasting 45 days. In the adult stage the insects are active. Adults feed on the leaves, flowers, buds, and stems. The most active periods are generally from 9 to 10 in the morning and late in the afternoon.

The larvae and the adults usually have the same hosts. Nearly all kinds of cultivated plants were found attacked by one or more species, although some species were confined to certain particular classes of plants. *Psylliodes* spp. are generally found on solanaceous plants and *Nisotra* on *Malvacae* both wild and cultivated. In some cases, as with *Luperomorpha prolixa* Er., several classes of cultivated plants are attacked. Out of the thirteen species studied, six were actually found on wild plants, and the rest most probably may tide over certain periods on the wild plants if conditions necessitate.

Experiments on starvation show that most of the beetles die the first day and the rest die within three days in case of *Psylliodes* and in 10 days in the case of *Nisotra*. Punctured leaves and flowers, holes in the epidermis of the stems or the fruits, yellowing and falling of large numbers of the leaves, and in some cases defoliations, are signs of the attack of adults. Gradual drying of attacked leaves and tips are signs of larval attack.

Field conditions showed that in general the beetles are in great abundance in the months of December and January. Occasionally they are found during the months from March to August but rarely from September to November. *Nisotra gemella* Er. may appear in more or less abundance throughout the year.

Their habits in the larval, as well as in the adult stage, facilitate their being carried from place to place with hosts.

No preventive measures of control have been carried out, but the biological facts and habits of these insects point to the feasibility of such methods. With these facts about the particular species, rotation of crops may be effective.

Spraying was tried as a means of control. Experiments showed that spraying with paris green is not very effective. A mixture of paris green and Bordeaux mixture was found to be effective in controlling the insect in the field and to insure the normal growth of the crops attacked.

RECOMMENDATION

In fighting these insects, efforts should be directed toward the adult stage. In controlling the adult, spraying and rotation of crops to suit particular species should be practiced.

Weeds and wild plants serving as hosts should be destroyed.

Spraying should be done early in the morning or before late in the afternoon to be most effective.

As to quarantine measures, the soil going with plants should be examined for eggs, larvae, and pupae, and the plant for eggs, and signs of attack by either larva or adult. Infected plants, discovered in transit, should be destroyed.

ACKNOWLEDGMENT

The author is indebted to Prof. Harold E. Woodworth of the Department of Entomology, under whom this work was undertaken, for his valuable suggestions and criticisms during the progress of the work and in the preparation of this paper; to Charles F. Baker, Dean of the College of Agriculture, for identification of the insects which are reported; to Dr. Elmer D. Merrill, Botanist and Director of the Bureau of Science, for identification of some of the plants which are found to be the food plants of the insects studied.

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ILLUSTRATIONS

Plate I.

Fig. 1.—Adult *P. balyi* Jacq. x 25.
2.—Egg x 50.
3.—Larva x 20.
4.—Adult *P. splendida* Har. x 15
5.—Egg x 50
6.—Larva x 20

Plate II.

Fig. 1.—Adult *N. gemella* Er. x 20
2.—Egg x 50
3.—Larva x 20
4.—Pupa x 20

Plate III.

Eggplant attacked by *P. balyi* Jacq. and *P. splendida* Har. Note the defoliated branches and the characteristics of the attacks on the leaves.

Plate IV.

Roselle plant attacked by *N. gemella* Er. Note the defoliated branches and the adult beetles on the stem feeding on the tissues of the epidermis.

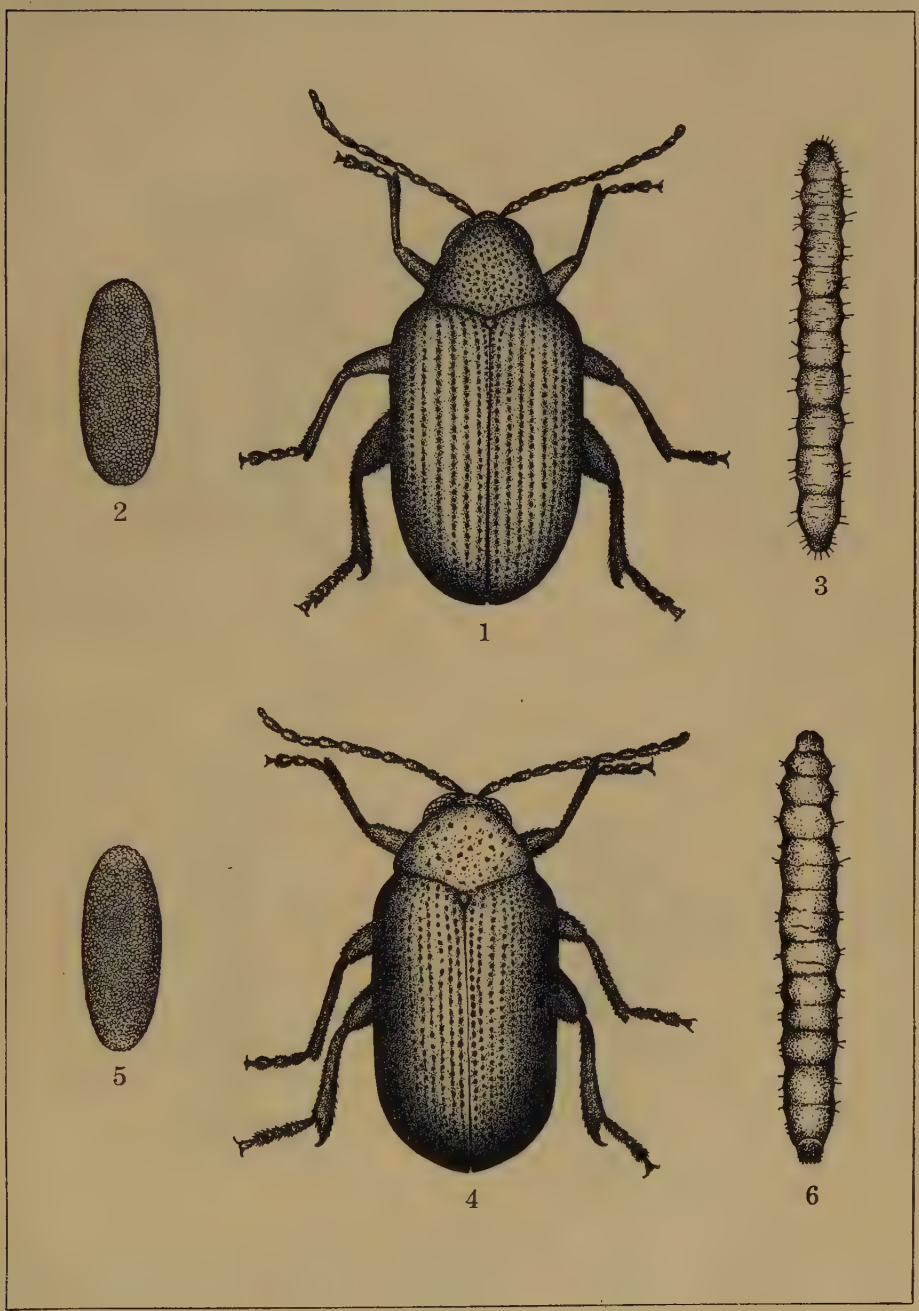

PLATE I.

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PLATE II.

PLATE III.

PLATE IV.

A HOST INDEX OF INSECTS INJURIOUS TO PHILIPPINE CROPS: III[1]

By H. E. Woodworth

Of the Department of Entomology

In this supplementary index of economic insects of the Philippines are listed a number of the less commonly met lepidopterous pests, which have been bred from larvae found attacking the plants under which they are listed. A few of these, however, deserve more than passing notice, and one in particular, *Margaronia caesalis* Walk., a pest of *Artocarpus communis* Forst., will receive individual discussion in a separate paper.

Earias fabia Stoll., a beautiful little noctuid, has been observed as a rather serious pest of Okra pods. It is a rather common Indian and Javan pest of malvaceous plants. Dammerman[2] calls it the "Englesch-Indische" cotton bollworm. It enters the pod either at the tip or side and feeds upon the seeds. So far, it has not been recorded from cotton in the Philippines, but undoubtedly it will be found attacking this plant also, as is its habit in other countries.

A most interesting pyralid borer (*Alophia* sp.) has been bred from the fruits of the Chico (*Achras sapota* Linn.). Mr. William Schaus of the United States National Museum, who has furnished me many of the lepidoptera determinations, states that it is an undescribed species. Although it is not abundant, it seems odd that such a conspicuous pest of a commercial fruit should remain unknown to science until this time. The frass-covered holes in the fruit and the "worm eaten" inside, render the fruit uneatable and unmarketable.

During the months of November, December, January, February and March a large psychid (*Clania fuscescens* Snell) was abundant on several hosts on the college campus. The "bag" is slender and conical, grayish white with several variable irregular black spots. It is one of the largest of the bag worms of this region and sometimes occurs as a pest of Citrus, Bignay (*Antidesma bunius* (L.) Spreng.) and others.

The arctiid, *Maenas maculifera* Walk. has occurred from time to time as a serious defoliator of Ilang-ilang (*Canangium odoratum* (Lam.) Baill.) and Mango (*Mangifera indica* Linn.). The larvae spin webs over the trunk and in the crotches of the trees and migrate to the leaves for feeding. Several trees on the college campus have been practically defoliated by this pest during the last year. The attack was easily controlled by burning the webs and spraying the foliage with lead arsenate.

Orgyia postica Walk. has been found attacking Citrus and Mango in addition to its previously reported hosts[3]. The variety of plants attacked by this pest and the seriousness of some of the infestations, place it with *Prodenia litura* Fabr. and *Chloridea obsoleta* Fabr. as a general farm pest. It has a wide distribution, extending from India through the Indo-malayan sub-region to Formosa, and has been recorded as an important pest in several of these countries.

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1 Experiment Station contribution, No. 92.

2 Dammerman, K. W. Landbouwdierkunde van Oost-Indie, pp. 368, Amsterdam, 1919.

3 Woodworth, H. E. A Host Index of Insects Injurious to Philippine crops. Philippine Agriculturist **10**: 9-35, 321-329. 1921, 1922.

Two small leaf rolling moths have been bred from cotton leaves, and are added to the numerous cotton insects of the Philippines. *Sylepta derogata* Fabr., a leaf roller recorded from India and Java, is found here in large numbers and may be considered as a major pest of cotton as grown at the College of Agriculture. Three interesting parasites have been bred from the larvae, *Chalcis obscurata* Walk., *Elasmus philippinensis* Ashm. and *Pleurotropis* sp.[4] *C. obscurata* Walk. was also bred from the larvae of *Margaronia caesalis* Walk. *Homona menciana* Walk., a small tortricid, is also found attacking cotton here, but to a less extent than *S. derogata* Fabr.

Another cane borer has been added to the Philippine list, *Sesamia uniformis* Dudgeon. This borer was bred from specimens taken at San José, Mindoro. The larvae were observed burrowing in the cane at the "points" or buds and it might properly be called a "point borer". This species has been recorded from India as an important cane pest. While not found in large numbers at San José, further investigation may prove it to be a factor in sugar production here. Several specimens have since been collected at Pansol, Laguna.

Investigations carried on by the Department of Entomology during the year have brought out much valuable information concerning the life histories and habits of certain Philippine flea beetles. Several of the interesting and important host records of flea beetles included in this list are the result of these investigations, a report of which is being published in this journal.[5]

HOST INDEX

ABELMOSCHUS ESCULENTUS (L.) Moench. (*Hibiscus esculentus* L.) (Okra, Gumbo.)

LEPIDOPTERA (Heterocera)

NOCTUIDAE

Earias fabia Stoll.

ACHRAS SAPOTA Linn. (Chico)

LEPIDOPTERA (Heterocera)

PYRALIDAE

Alophia sp.

PSYCHIDAE

Clania fuscescens Snell.

ANONA SPP. (Guanabanos, Soursop, Anonas, Custard Apple, Ates, Sugar Apple.)

DIPTERA

TRYPETIDAE

Dacus cucurbitae Coq.
Dacus ferrugineus Fabr.

ANTIDESMA BUNIUS (L.) Spreng. (Bignay)

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[4] Determined by A. B. Gahan, U. S. Department of Agriculture, Washington, D. C.

[5] Reveche, Feliciano. Life history and habits of some common Philippine flea beetles. Philippine Agriculturist **11**:2, 29-48. 1922.

LEPIDOPTERA (Heterocera)

PSYCHIDAE

Clania fuscescens Snell.

ARACHIS HYPOGAEA Linn. (Mani, Peanut.)

COLEOPTERA

CHRYSOMELIDAE

Lupermorpha prolixa Erichs

ARTOCARPUS COMMUNIS Forst. (Colo, Pacac, Bread fruit)

LEPIDOPTERA (Heterocera)

PYRALIDAE

Margaronia caesalis Walk.

BRASSICA SPP. (Cabbage, Mustard, Turnip, Pechay.)

COLEOPTERA

CHRYSOMELIDAE

Phyllotreta spp.

CANANGIUM ODORATUM (Lam., Baill. (*Cananga odorata* Hk. f & Th.) (Ilang-ilang)

LEPIDOPTERA (Heterocera)

ARCTIIDAE

Maenas maculifera Walk.

CANAVALIA SPP. (*C. ensiformis* (L.) DC.; *C. gladiata* (Jacq.) DC.) (Haba.)

LEPIDOPTERA (Heterocera)

PYRALIDAE

Maruca testulalis Geyer.

THYRIDIDAE

Striglina scitaria Walk.

CITRULLUS VULGARIS (L.) Schrad. (Sandia, Watermelon.)

DIPTERA

TRYPETIDAE

Dacus caudatus Fabr.

CITRUS SPP. (Dayap, Limon, Lucban, Suha, Pomelo, Narangita, Sitones, Calamondin, Calamansi.)

LEPIDOPTERA (Heterocera)

LYMANTRIIDAE

Euproctis flavata Cram.

Orgyia postica Walk.

PSYCHIDAE

Clania fuscescens Snell.

HEMIPTERA (Homoptera)

COCCIDAE

Chrysomphalus dictyospermi Morg.
Lepidosaphes becki Newm.
Lepidosaphes gloveri Pack.
Parlatoria brasiliensis Morr.
Parlatoria pergandii Comst.
Parlatoria proteus Curt.
Pseudaonidia trilobitiformis Green.

COLOCASIA ESCULENTUM (L.) Schott. (*C. antiquorum* Schott.) (Gabi, Taro.)

HEMIPTERA (Homoptera)

COCCIDAE

Pseudococcus virgatus Ckll.

CROTALARIA SPP.

COLEOPTERA

CHRYSOMELIDAE

Longitarsis manilensis Weise.

DOLICHOS LABLAB Linn. (Lablab Bean.)

COLEOPTERA

CHRYSOMELIDAE

Pagria graphica Weise.

GOSSYPIUM SPP. (Bulac, Algodon, Cotton.)

LEPIDOPTERA (Heterocera)

PYRALIDAE

Sylepta derogata Fabr.

TORTRICIDAE

Homona menciana Walk.

HIBISCUS SABDARIFFA Linn. (Roselle.)

COLEOPTERA

CHRYSOMELIDAE

Chaetocnema sp.
Nisotra gemella Erichs.

IPOMOEA BATATAS (L.) Poir. (Camote, Sweet Potato.)

COLEOPTERA

CHRYSOMELIDAE

Prionispa sp.

MANGIFERA INDICA Linn. (Manga, Mango.)

LEPIDOPTERA (Heterocera)

ARCTIIDAE

Maenas maculifera Walk.

LYMANTRIIDAE
Orgyia postica Walk.
NOCTUIDAE
Chlumetia transversa Walk.
PYRALIDAE
Macalla sp.
Orthaga melanoperalis Hamps.

MUSA TEXTILIS Nee (Abaca.)

LEPIDOPTERA (Heterocera)
NOCTUIDAE
Phytometra chalcites Esp.

ORYZA SATIVA Linn. (Palay, Arroz, Rice.)

LEPIDOPTERA (Heterocera)
PYRALIDAE
Marasmia venilialis Walk.

COLEOPTERA
CHRYSOMELIDAE
Chaetocnema sp.

PERSEA AMERICANA Mill. (P. gratissima Green.) (Alligator Pear, Avocado.)

LEPIDOPTERA (Heterocera)
GEOMETRIDAE
Pingasa ruginaria Guen.
PYRALIDAE
Endocrossis quinquemaculalis Saub.

HEMIPTERA (Homoptera)
COCCIDAE
Fiorinia fioriniae Targ.
Icerya seychellarum Westw.
Pseudococcus filamentosus Ckll.

PHASEOLUS spp. (Patani, Lima Bean, Mungos, Green Gram, Habichuela, Bean.)

LEPIDOPTERA (Heterocera)
ARCTIIDAE
Palaeopsis diaphanella Hamps.
NOCTUIDAE
Mocis undata Fabr.
Thermesia rubicans Boisd.
GEOMETRIDAE
Hyposidra talaca Walk.
PYRALIDAE
Maruca testulalis Geyer

COLEOPTERA

CHRYSOMELIDAE

Pagria graphica Weise

COCCINELIDAE

Epilachna 28-punctata Motsch.

PSIDIUM GUAJAVA Linn. (Bayabas, Guayaba, Guava.)

DIPTERA

TRYPETIDAE

Dacus cucurbitae Ccq.

Dacus ferrugineus Fabr.

HEMIPTERA (Homoptera)

COCCIDAE

Coccus viridis Green.

RAPHANUS SATIVUS Linn. (Rabano, Radish.)

COLEOPTERA

CHRYSOMELIDAE

Phyllotreta sp.

RICINUS COMMUNIS Linn. (Tangan-tangan, Castor Oil Plant.)

LEPIDOPTERA (Heterocera)

LYMANTRIIDAE

Lymantria mendosa Hubn.

SACCHARUM OFFICINARUM Linn. (Tuba, Caña Dulce, Sugar Cane.)

LEPIDOPTERA (Heterocera)

NOCTUIDAE

Sesamia uniformis Dudgeon.

PYRALIDAE

Scirpophaga virginia Schultze.

SOLANUM CUMINGI Dunal. (Tarambulo.)

COLEOPTERA

CHRYSOMELIDAE

Psylliodes balyi Jac.

Psylliodes splendida Har.

SOLANUM MELONGENA Linn. (Talong, Berenjena, Egg Plant.)

COLEOPTERA

CHRYSOMELIDAE

Aulacophora sp.

HEMIPTERA (Homoptera)

JASSIDAE

Nephotettix sp.

THEOBROMA CACAO Linn. (Cacao, Chocolate.)

HEMIPTERA (Homoptera)

COCCIDAE

Pseudococcus virgatus Ckll.

VIGNA spp. (Sitao, Cowpea.)

LEPIDOPTERA (Heterocera)

PYRALIDAE

Lamprosema indicata Fabr.

COLEOPTERA

CHRYSOMELIDAE

Longitarsis manilensis Weise.

Pagria graphica Weise.

ZEA MAYS Linn. (Mais, Corn, Indian Corn, Maize.)

COLEOPTERA

CHRYSOMELIDAE

Chaetocnema sp.

Hespera sp.

Luperomorpha prolixa Erichs.

ANNUAL RÉSUMÉ OF THE CLINICAL ACTIVITIES OF THE COLLEGE OF VETERINARY SCIENCE[1]

By L. P. Koster and J. B. Ashcraft

WITH ONE PLATE

The value to a college of veterinary science of a successful clinic cannot be overestimated and is at once so apparent to even the most casual observer that any dilation on the subject seems superfluous; in fact it seems almost impossible to conceive of such an institution not including the operation of a clinic within the scope of its activities. So general is the acceptance of this premise without question or second thought that it may not be out of place here to devote some reflection to the matter and inquire into the causes for such an unanimity of opinion.

The prime motive of a veterinary college in conducting a clinic is likewise the most obvious one, that is, to augment and complete the instruction imparted to its students in the classroom and to afford them demonstrations of and opportunities to apply in actual practice the principles and theories of the lecture hall. The clinic is to the prospective veterinarian what the laboratory is to the student of chemistry.

Another advantage of great importance afforded by a clinic is the generous opportunity it offers for scientific inquiry and experimentation. Much of this would otherwise be possible only at great expense and observations would, in consequence, be restricted to a considerable degree. The clinic is a fertile source for the acquirement of new knowledge and a most prolific aid to the progress and advancement of the science.

Another aspect of a well conducted clinic is the advantage and benefit it confers upon the animal-owning population of the community in which the clinic is located. While this phase is incidental as far as the college is concerned, its value to the class mentioned cannot well be overstated.

The clinic of the College of Veterinary Science, University of the Philippines, is conducted daily between the hours of 10 and 12 a. m. and during the past year has been under the joint direction of the writers assisted by Dr. Miguel Manresa. During one month of the hot weather while the first two mentioned members of the staff were absent from the College direction of the clinic was assumed by Dean A. S. Shealy.

The present accommodations are temporary and consist of a large nipa shed with a concrete floor providing stabling for seven large animals and a dressing floor. The number of hospital cases has at various times exceeded the available quarters and to meet this demand a second temporary structure of light materials has been improvised adjacent to the principal shed. Small animals are confined in portable cages arranged in rows under the main roof.

The surgical equipment is complete in every detail, including operating tables for both large and small animals and an assortment of instruments which permits

[1] Experiment Station Contribution No. 93.

of the performance of any operation. A well stocked pharmacy is maintained affording ample facilities for medical treatment.

The object of the present paper is to present in related form such statistics of the clinic of the College of Veterinary Science of the University of the Philippines as will show the value thereof to the students of the College and indicate possible avenues of investigation. The data presented covers the school year July 1, 1921, to June 30, 1922.

PRESENTATION OF DATA

DISEASES ENCOUNTERED

The instructive value of a clinic is not only determined by mere numbers but also by the variety of diseased conditions and the range of species presented for treatment. A perusal of Tables I and II shows the medical and surgical cases met with during the past year at the clinic of the College of Veterinary Science and discloses a most gratifying condition in this regard. It will be seen that there were under medical treatment a total of 208 cases distributed among eight different varieties of animals and representing 64 different types of disease. A satisfactory condition is likewise revealed in Table II which shows that 75 different conditions of a surgical nature were encountered in 245 animals during the same period, distributed among ten species.

TABLE I.—*Classification of medical diseases and species.*

Diseases.	Species.								
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls.	Guinea pigs.	Total.
Acne	1	....	....	....	....	....	....	....	1
Anemia, parasitic	....	....	....	1	....	....	....	....	1
Anorexia	....	....	1	....	....	....	....	....	1
Anthrax	....	....	2	....	....	....	....	....	2
Arythmic cordis	1	....	....	....	....	....	....	....	1
Ascariasis	1	4	2	....	....	....	....	4	11
Botulism	....	....	....	....	....	....	3	....	3
Bronchitis, chronic	1	....	....	....	....	....	....	....	1
Bronchitis, verminous	....	....	....	....	4	....	....	....	4
Catarrh, gastro-intestinal	3	....	....	1	1	....	....	....	5
Catarrh, nasal, acute	1	....	....	....	....	....	....	....	1
Catarrh nasal, chronic	6	....	....	....	....	....	....	....	6
Congestion of the brain	....	....	....	1	....	....	....	....	1
Congestion, pulmonary	1	....	....	....	....	....	....	....	1
Coryza	6	1	....	....	....	....	....	....	7
Conjunctivitis	....	2	2	....	1	....	....	....	5
Distemper, Canine	....	5	....	....	....	....	....	....	5

Diseases.	Species.								
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls.	Guinea pigs.	Total.
Eczema	....	5	....	2	....	....	....	4	11
Emphysema, alveolar	1	....	....	....	....	....	....	....	1
Enteritis, catarrhal	2	....	....	....	....	....	....	....	2
Epitheliosis, infectiosa avium (roup)	....	....	....	....	....	....	34	....	34
Favus	....	....	....	1	....	....	....	....	1
Fowl cholera	....	....	....	....	....	....	2	....	2
Fowl typhoid	....	....	....	....	....	....	1	....	1
Gastritis, catarrhal	....	....	....	2	....	....	....	....	2
Gastritis, chronic	....	1	....	....	....	....	....	....	1
Gastro-enteritis	1	....	....	....	1	....	....	....	2
Glanders	6	....	....	....	....	....	....	....	6
Glanders suspect	1	....	....	....	....	....	....	....	1
Hog cholera	....	....	....	....	6	....	....	....	6
Influenza	9	....	....	....	....	....	....	....	9
Impaction of rumen	....	....	....	1	....	....	....	....	1
Keratitis	....	....	2	5	....	....	....	....	7
Keratitis, parasitic	....	....	2	....	....	....	....	....	2
Laryngitis	1	....	....	1	....	....	....	....	2
Mange, follicular	2	2	....	....	....	....	....	....	4
Mange, psoroptic	2	....	....	....	....	....	....	....	2
Myositis	....	....	1	....	....	....	....	....	1
Obstipation	....	2	....	....	....	....	....	....	2
Oedema, stagnation	2	....	....	....	....	....	....	....	2
Osteomalacia	....	....	....	....	....	....	1	....	1
Osteoporosis	3	....	....	....	....	....	....	....	3
Otitis externus	....	....	....	7	....	....	....	....	7
Paralysis, facial	1	....	....	....	....	....	....	....	1
Paraplegia	....	....	....	....	....	....	1	....	1
Pharyngitis	....	1	....	....	....	....	....	....	1
Phthiriasis	1	3	....	....	....	1	....	....	5
Pneumonia	2	....	....	....	1	....	1	....	4
Poisoning, arsenic	....	1	....	....	....	....	....	....	1

Diseases.	Species.								
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls.	Guinea pigs.	Total.
Uncinariasis	....	2	....	....	....	....	....	....	2
Urticaria	4	....	....	....	....	....	....	....	4
Rabies	....	1	....	....	....	....	....	....	1
Rabies suspect	....	1	....	....	....	....	....	....	1
Rheumatism, muscular	2	....	....	....	....	....	....	....	2
Rinderpest	....	....	....	1	....	....	....	....	1
Surra	4	....	....	....	....	....	....	....	4
Stomatitis	3	....	....	....	....	....	....	....	3
Strangles	1	....	....	....	....	....	....	....	1
Strongylosis	1	....	....	....	....	....	....	....	1
Taeniasis	....	....	....	....	....	....	1	....	1
Tetanus	1	....	....	....	....	....	....	....	1
Thrush	2	....	....	....	....	....	....	....	2
Toxemia	....	....	....	....	....	....	1	....	1
Tympanites	....	....	....	1	....	....	....	....	1
Total	72	31	12	24	14	1	45	8	208
Examinations, physical	5	....	2	....	....	....	....	....	7
Examinations for pregnancy	2	....	....	....	....	....	....	....	2
Grand total	79	31	14	24	14	1	45	8	217

TABLE II.—*Classification of surgical diseases and species.*

Diseases.	Species.										
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls.	Goats.	Guinea pigs.	Monkeys.	Total
Abscess, flank	....	....	....	2	....	....	....	....	....	....	2
Abscess, foot	....	1	....	....	....	....	....	....	....	....	1
Abcess, head	....	....	....	....	....	....	....	....	1	....	1
Abrasion, tail	2	....	....	....	....	....	....	....	....	....	2
Amputation, external ear	....	....	....	1	....	....	....	....	....	....	1
Arthritis, fetlock	1	....	....	....	....	....	....	....	....	....	1
Atresia ani	....	....	....	....	....	....	....	....	....	1	1

Diseases.	Species.										
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls	Goats.	Guinea pigs.	Monkeys.	Total
Burn	1										1
Burn, rope			1		1						2
Bursitis, fetlock	4										4
Calculi, cystic					1						1
Capped hock	1										1
Carpitis	4										4
Castration	6	6	2	12		2		2			30
Contracture, flexor tendons	2										2
Contracture, suspensory ligament	1										1
Contusion	10			2							12
Cryptorchidism	1										1
Dehorning			1	1							2
Dystokia				1							1
Fibro-lipoma		1					1				2
Fistula, withers	1										1
Forging	4										4
Fracture, femur				1							1
Fracture, pelvis	1										1
Gall, saddle	3										3
Gall, collar	4										4
Gonitis	1										1
Granuloma				1							1
Heels, contracted	2										2
Hematoma				1							1
Interfering	1										1
Laminitis	4										4
Lipoma				1			1				2
Lymphangitis, epizootic	6										6
Melanosis	2										2
Metritis, septic					1						1
Myiasis dermatosa			2	6			1				9

Diseases.	Species.										
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls.	Goats.	Guinea pigs.	Monkeys.	Total
Oedema, traumatic	1		1								2
Orchitis	1										1
Ovariectomy					1						1
Paraphimosis		1									1
Periostitis, metacarpal	1										1
Pododermatitis, acute	2										2
Prolapse, rectal							1		1		2
Pyemia							1				1
Ringbone	5										5
Sarcoma, vaginal		1									1
Sesamoiditis	3										3
Shoe boil	1										1
Spavin	6										6
Splint	3										3
Sprain, hock	1										1
Subluxation, patella	3										3
Subluxation, tarsus							1				1
Step mouth	1										1
Street nail, penetrating	14										14
Teeth floated	32										32
Teeth truncated	3										3
Tendinitis, acute	6										6
Tendinitis, chronic	4										4
Tendo-vaginitis	1										1
Trimming ears and tail		3									3
Wavy mouth	4										4
Wound, corneal	1										1
Wound, digital				5							5
Wound, fetlock	1										1
Wound, gunshot			2	1							3
Wound, head	2			3							5

Diseases.	Species.										
	Horses.	Dogs.	Carabaos.	Cattle.	Hogs.	Cats.	Fowls.	Goats.	Guinea pigs.	Monkeys.	Total
Wound, metacarpal	3										3
Wound, penetrating facial				1							1
Wound, penetrating rumen				1							1
Wound, tibial region					1						1
Wound, tarsal	1										1
Wound, vaginal				3							3
Total	162	13	9	43	4	3	6	2	2	1	245

DIAGNOSIS

Both senior and junior students are required to attend clinic. The same cases are used for both classes, each case being assigned to a senior student, he having one or more juniors as assistants. Each group of students is held responsible for making a detailed examination of the patient assigned in a systemic and methodical manner and, with the assistance of the instructor, for making a diagnosis. The history of the case and the observations and findings upon which the diagnosis is based are recorded by the senior student on a hospital entrance chart and this chart is kept on file for future reference with all other records pertaining to the particular case.

One group of clinical students is assigned every two weeks to the pathology department for the purpose of conducting post-mortem examinations upon all cases which terminate fatally. The group is required to make laboratory examinations of specimens of diseased tissues and other material collected from cases in the hospital. The work is performed under the supervision of the department concerned and the findings are recorded on a laboratory diagnosis chart by the students.

The laboratory examinations are of immense value in establishing a prompt and accurate diagnosis as it is upon such determination that the course of treatment and subsequent method of handling the case depends. The specimens are of considerable teaching value in that they furnish material for showing the lesions of certain diseases, as well as the bacterial and parasitic causative agents, that could be obtained otherwise only with difficulty. The importance of laboratory examinations to the clinician in verifying, in modifying, or in refuting his tentative diagnosis has already been referred to and is not infrequently the cause of checking the spread and dissemination of destructive epizootics. Finally there exists the possibility that such examinations may reveal something that has not been before described or recognized. Reference to an instance illustrating this in a convincing manner will be found further on in this article.

TABLE III.—*Laboratory diagnoses.*

Kind of examination	No. of examinations.	No. negative	No. positive	Findings. Organisms.
Blood	112	106	6	Trypanosoma evansi (4). Filaria immitus (2).
Fecal	33	14	19	Taenia ova (2). Ascaris ova (10). Strongylus ova (1). Uncinaria ova (6).
Pus	7	3	4	Cryptococcus farciminosus (4).
Skin scrapping	35	25	10	Demodex folliculorum, canine (2). Demodex folliculorum, equine (1). Herpes tonsurans (1). Dermanyssus avium (1). Pulex serraticeps (2). Hematopinus equi (1). Psoroptes communis, equine (2).
Tissue	8	0	8	Lipoma (4). Melanoma (2). Sarcoma (1). Granuloma (1).
Mallein test	10	4	6	

Table III shows that a total of two hundred and five laboratory examinations were made during the past year. While the bulk of this work was performed under the supervision and direction of Dr. L. C. Neer of the Department of Pathology, other collaborators who gave valuable aid and assistance were Doctors Schwartz and Tubangui of the Department of Parasitology of the College of Veterinary Science and Prof. H. E. Woodworth of the Department of Entomology of the College of Agriculture.

TREATMENT

The medicinal treatment of all cases is determined by the instructors in charge after soliciting suggestions from and discussing freely the case from all angles with the students. The instructor gives his reasons for selecting the drugs he has prescribed and the manner in which they should be administered. The prescription is written by the senior student in charge of the case following the directions of the instructor. The prescription is filled by another group of clinical students detailed to the pharmacy for periods of two weeks. Each prescription is signed by the writer and checked for accuracy by the student who receives and compounds it, the latter certifying to the fact by signing his name on the back of the form. These prescriptions are later carefully scrutinized by a member of the clinical staff and any irregularities are called to the attention of both the prescriber and compounder, who are required to correct and present the prescription to him for his approval. In such manner 270 prescriptions were compounded and dispensed by students during the year.

Surgical operations are performed by an instructor assisted by the students to whom the case happens to be assigned, except those operations which because of the frequency of their occurrence or their minor nature, the students are thoroughly familiar with and are capable of performing without detriment to the patient. In these cases every opportunity is afforded the student to improve his operative technique and to acquire self assurance and confidence in himself by being thrown upon his own resources. All major operations or those of a lengthy, painful character are performed under general anesthesia administered by the students assigned to the case. All work preparatory to the operation, such as shaving the field of operation and sterilizing both it and the instruments to be used, is accomplished by the students.

The senior student in charge of the case is required to fill out an operation chart describing in detail the immediately previous condition of the patient, the preparations for the operation, restraint, anesthetic, and instruments employed, the progress and nature of the operation, condition of the patient at the conclusion of the operation, and the dressing applied to the wound.

Daily treatment of cases both medical and surgical is administered by the students. A record of treatment procedure is entered on the daily hospital record on which appear also the results of the daily clinical examinations. The two charts relate the progress of the case from day to day and tend to develope the students' powers of observation and ability to interpret and appreciate the significance of any changes the patient may manifest. Effort is made to familiarize every student with each case admitted to the hospital. To this end re-assignments of cases are made at intervals of two weeks.

AUTOPSIES

During the year the department of pathology performed 69 post-mortem examinations. Eighteen of these cases do not appear in the records of the clinic as they were either brought to the hospital dead for the purpose of diagnosis or they were cases posted in the field. A thorough and complete post-mortem examination was made of all animals dying in the clinic, thereby enabling the students to check their clinical diagnoses and to become familiar with the morbid anatomy of the 37 different diseases encountered in autopsies of the year. Post-mortem instruction is of first importance to the students, training them in the technique of making the post-mortems, the detection of morbid changes, and the recognition of the death-causing disease.

Suitable and representative specimens of pathological lesions are preserved in the College Museum, increasing its usefulness as an aid in the teaching of pathology. The Museum while as yet small contains specimens of all the common conditions and its value continually increases as new specimens are added from time to time.

Below is a complete list of post-mortem findings for the year:

Condition.	*Number.*
Anemia	3
Anthrax	3
Ascariasis	2
Botulism	1
Bronchitis, verminous	1
Congestion of the brain	1

Congestion of the lungs	1
Cerebritis, suppurative	1
Distemper, canine	2
Enteritis, hemorrhagic	1
Epitheliosis infectiosa avium	5
Filaria immitis	1
Fowl cholera	1
Fowl typhoid	2
Gastro-enteritis	1
Gastro-enteritis, mycotic	2
Gastro-enteritis, parasitic	1
Glanders	1
Hemorrhage, acute	3
Hog cholera	5
Impaction of intestines	1
Intussusception of intestines	1
Peritonitis	1
Pneumonia, catarrhal	1
Pneumonia, purulent	3
Pneumonia, verminous	1
Poisoning, mercurial	1
Poisoning, strychnine	8
Pyemia	2
Rabies	1
Rinderpest	3
Rupture of intestine	1
Septicemia	3
Surra	1
Strangles	1
Swine plague	1
Tetanus	1
Total	69

DISPOSITION OF CASES

Out of a total of 462 cases treated 283 or approximately 61 per centum were discharged from the hospital as cured. Ninety cases were undetermined. All of them, with the exception of one, were treated in the San Pablo Ambulatory Clinic where opportunity was not afforded for more than one treatment and consequently the outcome could not be ascertained. From the nature of their ailments, however, the probability is that all of these animals would have made a satisfactory recovery could treatments have been followed up for a reasonable length of time.

The death rate was relatively high due largely to the great proportion of fowls admitted to the hospital afflicted with infectious avian epitheliosa commonly known as roup. This disease runs a very grave course accompanied by a high rate of mortality and is responsible for a large number of the total deaths recorded. Another factor which contributed to this same result was the apparent reluctance of owners to bring their animals to the hospital before they had reached an advanced stage of disease or before the round of home remedies had been exhausted without producing results. Obviously such proceedure is highly prejudicial to chances of ultimate recovery and every effort is being made to correct this condition. Emphasis is being laid on the fact that everything connected with the treatment and boarding of the animal in the hospital is absolutely free of charge.

A substantial reduction in the death rate during the coming year is confidently looked for.

The following list shows the number and proportion for each disposition:

Disposition.	*Number.*	*Percentage.*
Number of cases discharged cured	283	61.2
Number of cases discharged improved	6	1.3
Number of cases discharged unimproved	3	.7
Number of cases destroyed	13	3.0
Number of cases died	51	11.0
Number of cases undetermined	90	19.4
Number of examinations	6	1.3
Number of cases still under treatment	10	2.1
Total number of cases	462	100.0

CONCLUSIONS

VARIETY OF SPECIES

To afford students a broad, well balanced veterinary education it is imperative that the cases offered by the clinic be well distributed as to species. The importance of this feature will be conceded at once and it is sufficient to say that a clinic restricted to but a few species of animals is seriously handicapped in its teaching facilities. The instructional value of the clinic to students is lessened in proportion to the decrease in number of species. Different species are affected with diseases peculiar to themselves and those diseases which affect more than one species are often exhibited in a modified and changed form in the different animals. Furthermore, the different species possess habits and characteristics which are peculiar to them and with which the student must be thoroughly familiar in order to become a successful diagnostician and clinician.

As the College of Veterinary Science is surrounded by an agricultural community and is in close proximity with the Department of Animal Husbandry of the College of Agriculture it is enabled to obtain in its clinic a representation of practically every domesticated species of animal which the student will encounter after his graduation. Such a location affords the advantage of closely simulating the conditions which the student finds in his native province. Such are, needless to say, totally at variance with those met with in an urban college.

The list inserted below sets forth the variety of species with the number and proportion of each that occurred in the clinic of the College of Veterinary Science during the past year:

Species.	*Number.*	*Percentage.*
Horses and mules	241	52.17
Cattle and carabaos	90	19.48
Swine	18	3.89
Fowl	53	11.47
Goats	2	.43
Total.—Economic animals	404	87.44
Dogs	44	9.52
Cats	3	.64
Guinea pigs	10	2.16
Monkeys	1	.21
Total.—Non-economic animals	58	12.53
Grand total	462	99.97

The conclusions to be drawn from the above data are:

(1) As regards variety of species the clinic of the College of Veterinary Science is most representative and complete.

(2) The proportion of species is well distributed according to their economic importance.

(3) The high predominance of economic over non-economic animals is significant of the utilitarian value of the clinic.

VARIETY OF DISEASES

The total number of diseased conditions listed in tables I and II is 139. Of this number 75 were of a surgical nature while the remaining 64 were of medical character. Of these 64, 13 were of an infectious character and 11 were of parasitic origin. The 13 infectious diseases embraced the following: anthrax, botulism in fowls, canine distemper, epizootic lymphangitis, fowl cholera, fowl typhoid, glanders, hog cholera, equine influenza, rabies, rinderpest, roup, and surra. The parasitic diseases included the following: ascariasis, parasitic anemia (cattle tick), verminous bronchitis, parasitic keratitis, follicular mange, psoroptic mange, phithiriasis, uncinariasis, strongylosis, taeniasis, and myiasis.

The above data indicate clearly what a heavy toll infectious and parasitic diseases exact from the live stock of the country and their economic menace. It also shows in a convincing manner how thorough and complete a representation of them is afforded by the clinic of the College.

The variety of sporadic conditions is sufficient and includes the most common affections of the class. Of special note in this connection is the relatively high number of cases of osteoporosis in horses which are recorded. This disease is characterized by a deficiency of lime salts in the bones and appears to be quite prevalent in the Philippines, at least in the vicinity of Los Baños.

The number of surgical cases is slightly in excess of medical cases and sufficient variety is afforded for teaching purposes. There is an ample number of cases of lameness varying in type, location, and degree to furnish frequent demonstrations and opportunity for thorough exercise in diagnostics.

NEW AND UNUSUAL CONDITIONS

Special interest is attached to some of the cases treated in the clinic during the past year because of their rare occurrence or for the reason that they presented some peculiarity in their course.

A new form of myiasis was encountered which was studied in some detail and on which a paper is now in preparation and about to be published by Professors Woodworth and Ashcraft.

Several cases of a heavy infestation of carabao calves with *Ascaris vitulorum* were treated with varying success. This condition promises to be of great economic importance as it is believed to be widespread in the Islands and to be the cause of a serious loss in young carabaos. To determine its extent and the best means of combating it requires considerable experimentation which it is hoped the College will soon be able to undertake. Further information on this condition is contained in the following articles by Dr. Benjamin Schwartz, of the College of Veterinary Science:

Observations on the life history of *Ascaris vitulorum* and the effects of extracts of *Ascaris vitulorum* on experimental animals. Philippine Journal of Science. (In press.)

Ascarid infestation of domesticated animals in the Philippine Islands. Philippine Agricultural Review. (In press.)

A monkey caught on Mount Makiling was found to be affected with atresia ani. The condition had evidently existed for some time and caused so great a depression in the animal that his capture was easily effected. Only the skin being imperforate, an operation was performed. The patient, however, succumbed two days later. Death was due to enteritis as was revealed by post-mortem examination.

Some very troublesome cases of otitis externus occurred in the Hereford cattle of the College of Agriculture. This condition was caused by maggots of the oriental screw worm fly *Compsomyia dux* Esch. and from its nature and the frequency of its occurrence it is believed that the fly was attracted to the ear by the presence of blood from crushed cattle ticks on the skin of the ear. The Herefords were quite heavily infested with ticks and in one case, that was discovered early, the crushed body of a dead tick was found attached to the hairs growing from the inside of the ear. The blood from its body covered a small area of skin on the internal surface of the ear and in this area one larva was found.

VOLUME OF CLINIC

While the number of cases in the clinic of the College of Veterinary Science is admittedly small and could with great advantage be increased, it must not be inferred that this is an inherent condition. Time alone will furnish the corrective for this deficiency and continual and progressive improvement in this direction is occurring constantly. In this connection it must be remembered that the clinic has been in operation for the short period of twenty months. As evidence of its increasing and vigorous growth the following figures are cited.

During the first eight months of the clinic's operation, from November, 1920, until the end of June, 1921, a total of 151 cases were admitted to the hospital, a monthly average of slightly less than 19 cases,

During the calendar year of 1921 a total of 356 cases were admitted, a monthly average of slightly less than 30 cases.

During the past academic year, from July 1, 1921, to June 30, 1922, from which the material for this résumé was drawn, a total of 462 cases were treated, a monthly average of 38.5 cases.

However, the teaching value of a clinic is not, as has been previously stated, entirely dependent upon the number of cases it supplies. Its real value lies in the opportunity it affords students of observing and studying cases until their recovery or death and, if the latter, of making a careful and thorough post-mortem examination. The number of "in cases," those quartered in the hospital during treatment, is in the clinic of the College of Veterinary Science very high (about 70 *per centum*) and so affords a proportionately greater opportunity for realizing the advantages of continuous logical treatment than is ordinarily the case in most clinics. This condition compensates in great part for what appears to be a serious shortage in numbers and makes more apparent than real any shortcoming in this direction which may be charged against the clinic.

ILLUSTRATION

PLATE I

A class in surgery. Clinic of the College of Veterinary Science.

PLATE I. A CLASS IN SURGERY. CLINIC OF THE COLLEGE OF VETERINARY SCIENCE

REVIEW

La vaccination contre la peste bovine, René van Saceghem (*From Comptes Rendus des Séances de la Société de Biologie 85: 878-9, 1921*).—Vaccination against rinderpest is one of the questions that is set down for to-day's discussion. The recent epizootic of rinderpest in Belgium, where, thanks to energetic measures, we succeeded in arresting it, and the epizootic of rinderpest which rages in East Africa, raise a series of questions which have a special bearing on the organization of the struggle against this pest. The struggle against this terrible scourge is based on various police sanitary measures, and more particularly on vaccination and serum immunization. The method of vaccination universally adopted is that of Kolle and Turner and is known as the simultaneous method. It consists in injecting cattle subcutaneously with rinderpest virus and immunizing serum, in two simultaneous injections. The question as to the quantity of virus and serum that are necessary to obtain a good vaccination has given rise, recently, to very lively discussions. Kolle and Turner recommended 0.66 cc. of rinderpest blood, withdrawn on the 5th day after the onset of the disease, and from 25 to 50 cc. of serum, depending upon the weight of the animal. The method of Schein also consists in two simultaneous injections but the quantity of rinderpest blood formerly injected is replaced by 1 cc. of a 1 to 1,000 dilution of rinderpest blood in anticoagulating physiological salt solution. The quantity of serum used is 50 cc. per 100 kilogram of weight of the animal to be vaccinated. Croveri, who has discussed the experiments Schein, proves that this procedure is not applicable to live-stock in Somalie and I am certain that it would yield no results in live stock in Ruanda. That the enormous quantity of serum injected by Schein neutralizes the weak quantity of virus, is beyond any doubt.

In practice it is very difficult to determine the real strength of the two important factors, namely, virus and serum. If, for a given dose of serum the virus that is injected is too much or too virulent, the serum cannot attenuate the disease and the animal dies of rinderpest. If, on the other hand, the given dose of virus is too weak or too small, the serum neutralizes it and there develops neither disease, vaccination nor immunity.

Moreover, I have observed that very often vaccination produces among feeble animals an apyretic condition, which always terminates fatally.

After six months of observation I have come to the conclusion that vaccination by the simultaneous method presents great disadvantages and gives very uncertain results. I must acknowledge that rinderpest virus can develop and produce the disease, in a so-called attenuated form, with a rise in temperature that persists for several days, with all the symptoms of rinderpest, resulting in the persistence in the organism of anti-rinderpest antibodies brought in by the inoculated serum. These antibodies, injected simultaneously with the virus, would, in my opinion, be rapidly neutralized, at least so far as concerns their anti-virulent properties. Serum injected simultaneously with virus ought to neutralize part of the virus and the disease should develop as if it had been produced by a smaller quantity of virus than that actually injected, thus causing the disease to run a milder course.

I have actually used successfully a new method of vaccination in place of the simultaneous method. This method consists in injecting very small doses of virus (1/10 cc. for animals in Ruanda); I allow the disease to develop naturally and on the second day after the onset of fever I inject 50 cc. of serum into the jugular vein. My experiments have proven that the intravenous method of injection is better than the subcutaneous.

The big advantage of this method consists in avoiding great dangers inherent in the former method of vaccination. We do not run the risk of neutralizing the virus, because we inject serum only when the disease is developing. Injection of serum when the animal is beginning to react to the disease aids the organism at the proper time, whereas in the simultaneous method of injection the serum frequently acts as a paralyzer of the defense system.

—Translated by B. Schwartz.

COLLEGE AND ALUMNI NOTES

Professor R. W. Barney of the University of Hongkong spent ten days at the College of Agriculture in July collecting Lepidoptera.

Associate Professor F. P. McWhorter has been transferred from the Department of Plant Physiology to the Department of Pathology. He will act as head of that department during the absence of Professor Reinking.

Associate Professor Nemesio B. Mendiola and Mr. Leon Gonzalez made a fruit study trip to the Lamao Experiment Station and another to Trinidad, Benguet, to look over the vegetable gardening work in the Trinidad Farm School. Professor Mendiola in May also made a trip with Mr. Vicente Aldaba through the provinces of Tayabas, Camarines Sur and Albay, as far as Tabaco to study local methods of abaca cultivation and gather data on which recommendations on hill selection may be based.

First-Lieutenant P. C. Sevilla arrived at the College on July 4 to take charge of the Department of Military Science and Tactics.

Letters reaching the College announce that I. Collado of the Class of 1919 will soon be returning to the Philippines. He is at present studying in the Illip School of Theology, Denver, Colorado, U.S.A.

Rufino Cuitiong, Class of 1922 of the College of Agriculture, died in the General Hospital on Aug. 19, 1922, at 3:00 p. m., as a result of an automobile collision.